merely a slight hissing. If, however, the mixture has been heated till vapours have begun to make their appearance, the reaction is extremely violent. It is therefore best to allow the contents of the crucible, after fusion, to cool down to a low red heat, when the introduction of the magnesium is perfectly safe. When all action has ceased, the contents of the crucible are again heated strongly, and afterwards allowed to cool until the furnace has become quite cold. On breaking the crucible, all the potassium chloride and the excess of manganous chloride is found to have been volatilized, leaving a regulus of metallic manganese, fused together into a solid block, about three parts by weight being obtained for every two parts of magnesium added. The metal, as thus obtained, is readily broken up by hammering into fragments of a whitish-gray colour possessing a bright metallic lustre. The lustre may be preserved for months in stoppered glass vessels, but, when exposed to air, the fresh surface becomes rapidly brown. The metal is so hard that the best files are incapable of making any impression upon it. It is so feebly magnetic that a powerful horse-shoe magnet capable of readily lifting a kilogram of iron has no appreciable effect upon the smallest fragment. It was noticed that the introduction of a small quantity of silica rendered the manganese still more brittle, and caused it to present a conchoidal fracture, that of pure manganese being uneven. The specific gravity of the metal, former determinations of which have been very varied, was found to be 7·3921 at 22° C. This number, which was obtained with a very pure preparation, is about the mean of the previous determinations. Dilute mineral acids readily dissolve the pulverized metal, leaving a mere trace of insoluble impurity. It is also satisfactory that practically no magnesium is retained alloyed with the manganese, and the introduction of carbon is altogether avoided by the use of this convenient method.

THE additions to the Zoological Society's Gardens during the past week include a Common Marmoset (*Hapale jacchus*) from South-East Brazil, presented by Mr. O. Burrell; a Common Squirrel (*Sciurus vulgaris*), British, presented by Miss B. Tatham; a Common Stoat (*Mustela erminea*) from Northamptonshire, presented by Mr. Cuthbert Johnson; a Wattled Crane (*Grus carunculata*) from West Africa, presented by Mr. Robert Sinclair, Jun.; a Redshank (*Totanus calidris*) from Devonshire, presented by Mr. R. M. J. Teil; a White-backed Piping Crow (*Gymnorhina leuconota*) from Australia, presented by Mr. W. H. Felstead; a Grey-headed Porphyrio (*Porphyrio poliocephalus*) from India, presented by Dr. Gerard Smith; a Common Chameleon (*Chamæleon vulgaris*) from North Africa, presented by Mr. G. W. Alder; a Dwarf Chameleon (*Chamæleon pumilus*) from South Africa, presented by Mrs. Leith; a Green Lizard (*Lacerta viridis*), European, presented by Mr. C. H. Whitlow; a Common Jay (*Garrulus glandarius*), European, purchased; five Carpet Snakes (*Morelia variegata*) from Australia, received in exchange.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m., November 21 = 2h. 3m. 21s.

Name.	Mag.	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ′
(1) G. C. 527	—	—	2 15 28	+41 35
(2) 15 Arietis	6	Yellowish-red.	2 4 31	+18 59
(3) α Arietis...	2	Yellow.	2 1 0	+22 57
(4) β Trianguli	3	Bluish-white.	2 3 0	+34 28
(5) DM + 56° 724 ...	9	Reddish-yellow.	2 42 32	+56 31
(6) R Tauri	Var.	Very red.	4 22 16	+ 9 55

Remarks.

(1) Sir John Herschel's description of this nebula is as follows: —! Bright, very large, very much extended. The spectrum has not yet been recorded.

(2) This is a star of Group II., in which Dunér records bands 2–8, but states that they are neither wide nor dark. The star falls in species 13 of the subdivision of this group, and is well advanced towards Group III. Metallic lines, and possibly hydrogen lines (dark) may therefore be expected. In the earlier stages of the group, no hydrogen lines appear, the radiation from the interspaces between the meteorites being balanced by the absorption of the gas surrounding the incandescent stones; but in the more advanced members, as in α Orionis, the absorption will probably be found to slightly predominate. The presence or absence of the F line, and of metallic lines, and their relative intensities, should therefore be noted.

(3) This is a star of either Group III. or Group V., and the usual criteria (see p. 20) should be observed in order to determine which. At the same time, the relative intensities of the hydrogen lines and the metallic lines (say *b* and D) should be recorded, so that the star may be placed in a line of temperature with others.

(4) According to Gothard this is a star of Group IV. The usual observations are required.

(5) Dunér classes this with Group VI. stars, but states that the type of spectrum is a little doubtful. Further observations are therefore required. As the most advanced stars of the group are very red, the colour of this star indicates that it probably belongs to an early stage of the group, in which the carbon bands would be narrow, and therefore somewhat difficult to observe with certainty; in that case traces of *b* and D might be expected. The colour should also be checked.

(6) Gore gives the period of this variable as 325·6 days, and the range as 7·4–9·0 at maximum to < 13 at minimum. The maximum will occur on November 30. The spectrum is of the Group II. type, and belongs to species 9. Dunér states that the dark bands, especially 7 and 8, are very wide. In several variables of this class (R Leonis, R Andromedæ, &c.), Espin has observed bright hydrogen lines near maximum, and the question is, Is this common to all the variable stars of this type? As stated with reference to 15 Arietis, under normal conditions the hydrogen lines in the earlier species of the group are absent, because the interspacial radiation balances the absorption; but if through some cause the temperature increases at maximum, more hydrogen would be driven into the interspaces and radiation would predominate. It may be mentioned that, according to the meteoritic theory, the increase of temperature and luminosity is brought about by the periastrion passage of a secondary swarm through the outliers of the central one. It is not unlikely that slight variations of colour will take place from maximum to minimum, and it is important therefore that the colour should be noted when the spectroscopic observations are made.

A. FOWLER.

THE MINIMUM SUN-SPOT PERIOD.—M. Bruguière, in *L'Astronomie*, November 1889, gives a series of observations made with a view to determine the exact date of the minimum sun-spot period. The following tables show the condition of the sun's surface with respect to spots from the beginning of January to the end of July of this year:—

Date, 1889.		No. of days without spots.	
Jan.	3–15	13	
,,	18–31	14	
Feb.	8–21	14	
Mar.	2–6	5	
,,	17–31	15	
April	11–30	20	25
May	1–5	5	
,,	10–26	17	
,,	28–31	3	18
June	1–15	15	
,,	29–30	2	13
July	1–11	11	
,,	25–27	3	

Date, 1889.		No. of days with spots.
Jan.	16–17	2
Feb.	1–7	7
,,	22–29	8
Mar.	1 and 8–16 ...	10
April	1–10	10
May	6–9	4
,,	27	1
June	16–28	13*
July	12–24	13*
,,	28–31	4

* The same spot.

If the small spots that were seen from May 6–9, and also on May 27, be neglected, it will be seen that there would be a period without spots extending from April 11 to June 15—that

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is, sixty-six days; but if these small spots be considered we find an interval of twenty-five days without spots—namely, from April 11 to May 5. The minimum period, therefore, appears to have passed about the end of April, this being the time when the greatest number of days passed without spots being observed on the sun. The new period opened with the appearance of a large spot on June 16.

RETURN OF BRORSEN'S COMET.—The following elements and ephemeris for this comet are given by Dr. E. Lamp in *Astronomische Nachrichten*, No. 2933:—

T = 1890 February 24·1358 Berlin midnight.

$$\left.\begin{array}{l} \omega = \;\;14^{\circ}\;55'\;35''\!\cdot\!89 \\ \Omega = 101\;\;27\;\;33\cdot74 \\ \iota = \;\;29\;\;23\;\;48\cdot25 \end{array}\right\}\text{ Mean Eq. 1890·0}$$

$$\phi = \;\;54\;\;\;7\;\;46\cdot19$$

$$\mu = 650''\!\cdot\!3693$$

Ephemeris for Berlin Midnight.

1889.	R.A. h. m. s.	Decl. ° ′
Nov. 21	22 9 17	−45 4·6
22	9 47	−44 50·3
23	10 19	−44 35·8
24	10 54	−44 21·2
25	11 31	−44 6·4
26	12 11	−43 51·4
27	12 53	−43 36·2
28	13 38	−43 20·8
29	14 25	−43 5·2
30	15 14	−42 49·4
Dec. 1	16 6	−42 33·4
2	17 0	−42 17·3
3	17 56	−42 0·9
4	18 54	−41 44·4
5	19 54	−41 27·7
6	20 57	−41 10·8
7	22 1	−40 53·6
8	23 8	−40 36·3
9	24 16	−40 8·7
10	25 27	−40 0·9
Dec. 11	22 26 40	−39 42·8
12	27 55	−39 24 6
13	29 11	−39 6·1
14	30 30	−38 47·4
15	31 50	−38 28·5
16	33 12	−38 9·3
17	34 36	−37 49 8
18	36 2	−37 30·1
19	37 29	−37 10·1
20	38 58	−36 49·8
21	40 29	−36 29·2
22	42 1	−36 8·4
23	43 35	−35 47·2
24	45 10	−35 25·8
25	46 47	−35 4·1
26	48 26	−34 42·0
27	50 6	−34 19·6
28	51 48	−33 56·8
29	53 32	−33 33·6
30	55 17	−33 10 0

THE COMPANION OF η PEGASI.—A companion to η Pegasi was discovered by Sir William Herschel in 1780, and subsequently observed by South in 1824. Its magnitude has been rated from twelve to fifteen. Mr. S. W. Burnham, however, notes (*Astronomische Nachrichten*, No. 2933) that, using the 36-inch refractor at the Lick Observatory, the Herschel companion appears as a close double. South's mean of two measures is given in his catalogue as:—

1824·84 338°·9 89″·82 2*n* S.

The following is the mean of four measures made at Mount Hamilton:—

η Pegasi.

B and C.					A and BC.		
1889·53	83°·3	0″·29	10·1	10·1	1889·53	339°·0	90″·38

The close pair is difficult, and can hardly fail to be a physical system, and Mr. Burnham thinks that, although it is not a test for the large telescope, it will not be seen with any small instrument.

GENERAL BIBLIOGRAPHY OF ASTRONOMY.—The second part of Vol. I. of this comprehensive bibliography has been published. It represents Houzeau's last work, and hence it is well that his biographical note, by A. Lancaster, should be included. The first part of Vol. I., published in 1887, contained the references to historical works and those relating to astrology; the part just published contains the references to biographies of astronomers and their epistolary communications, general astronomical works, astronomical societies and their proceedings, and everything relating to spherical astronomy. Works on theoretical astronomy are also well represented. The third and last part of Vol. I. is now in press, and contains references to all the published matter on the mechanism of the heavens, physical, practical, and descriptive astronomy, and the systems of cosmogony. The utility of this bibliography, when completed, needs no comment.

J. C. HOUZEAU'S "VADE MECUM."—With reference to our biographical note on J. C. Houzeau (p. 20), M. A. Lancaster writes to remind us that Houzeau's "Vade Mecum" was issued after the appearance of the second volume of the "Bibliographie Générale de l'Astronomie," the publication of which began in 1879. Moreover, the "Vade Mecum" was only a second edition of the "Répertoire des Constantes de l'Astronomie," inserted in 1877 in the first volume of the new series of the "Annales Astronomiques" of the Brussels Royal Observatory. The numerous materials brought together for the "Bibliographie Générale" suggested to Houzeau the idea of issuing a new edition of the "Répertoire" considerably corrected and enlarged.

A NEW COMET.—A new comet was discovered on November 17 by Mr. Lewis Swift, of the Warner Observatory, Rochester, New York. Place at November 17, 6h. 35m. 2s. G.M.T.; R.A. = 22h. 42m. 24s.; N.P.D. = 78° 9′. Daily motion in R.A., + 2m.; in N.P.D., − 15′. The comet was only faint.

MIRAGE IN THE SOUTH AMERICAN PAMPAS.

WAS staying in the Pampas of the Argentine Republic, near Melincue, a small town of the Province of Santa Fe, from September 1888 to March 1889. During my stay I had the opportunity of observing certain mirage phenomena. It is possible that my notes may contain something of interest. They were, designedly, taken without reference to any previous knowledge of the theory of mirage that I might possess.

To illustrate my observations I had drawn *eight* diagrams; but, for the purpose of insertion in NATURE, I have been obliged to reduce these to *two*. Hence I fear that my descriptions may not be as clear as I should wish.

The most general conclusion at which I arrived was that there were *two* classes of mirage of very different character. The one I shall call "the summer mirage," the other "the winter mirage." I would observe that, without a telescope of some sort, one would be unable to make observations of much value; and that, as I had but a binocular telescope, in many details I failed to make out as much as I could had I possessed a larger telescope steadily mounted.

I. *The Summer Mirage.*

(1) This mirage is seen in full day. I was told that in normal years it is most remarkable in the extreme heat of summer. The summer of December, January, and February 1888 and 1889 was abnormally wet, however. And I myself saw the mirage most frequently in spring (September, October, and the earlier part of November), the grass being then short and very dry. Later on the grass became very long, and unusually green and damp, owing to the heavy rains. And then I saw the mirage but rarely in the grass plains, though on the several occasions on which I passed, in the blaze of a summer day, the dry sandy bed of an old laguna, the mirage was there to be seen very clearly.

On one or two occasions in spring I saw the mirage when there was a fairly cold wind and no perceptible sunshine, but still in full day.

(2) This kind of mirage usually appeared as a strip of "water" running more or less parallel to the horizon, at one end narrowing to a point, and at the other end opening out into the sky. It appeared much as an arm of the sea, or an estuary, seen near the horizon, and running parallel to it. The "water" was of the same colour as the sky above it near the horizon.

(3) Viewed through glasses, the whole of the land seen above and beyond the "water," the "water" itself, and to a less extent the land seen just this side of it, appeared wavy and ill-defined, flocculent, and (when there was any breeze) possessed of a drifting movement down the wind. At the thin end of the "water," and just beyond it in the line of the layer, one could see broken fragments of "water" drifting over the land; and, in like manner, the peninsula of land appeared to end in a line of drifting fragments.

(4) It appeared to me that the land seen beyond the watery layer was either within the limits of the natural horizon, or not much beyond them. One did not, as one did in the "winter mirage," see houses, &c., that were normally out of sight.

(5) Cattle, &c., seen in the watery layer were ill-defined. But on the whole it seemed that their legs were hidden, and bodies were reflected inverted, much as if they had been standing in shallow water.

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